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(57) Abstract

The invention relates to a food product prepared by fermentation, based substantially on cereal bran, containing living microorganisms and being nutritionally beneficial, beneficial to health, and tasty. The invention also relates to a method of making easy-to-use fiber-rich food products having a pleasant taste. By the method, food products having a high dietary fiber content and being tasty, non-perishable and nutritionally valuable may be prepared by controlled fermentation by means of microorganisms having useful properties in view of the technology, health, or the product. Furthermore, the possibilities of functioning of the wholesome useful microorganisms used are improved as the dietary fiber components protect the microorganism when they are passed in the digestive system.

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Food product containing dietary fiber and method of making said product

Technical field

The invention relates to a food product prepared by fermentation, based substantially on cereal bran, containing living microorganisms, and being nutritionally beneficial, beneficial to health, and tasty. The invention also relates to a food biotechnological method of making easy-to-use fiber-rich food products having a pleasant taste. By the method, food products having a high dietary fiber content and being tasty, non-perishable, and nutritionally valuable may be prepared by controlled fermentation by means of microorganisms having useful properties in view of the technology, health, or the quality of the product.

In accordance with the method of the invention, a dietary fiber containing product, for instance cereal bran, is fermented either as such in an aqueous suspension or in a gel subsequent to heat treatment, using for the inoculation a microorganism which has useful properties in view of the technology, health, or the quality of the product, such as for instance lactic acid bacteria, propionic acid bacteria, or bifidobacteria or combinations thereof. The palatability of a dietary fiber containing product, for instance oat bran, may be improved by the method of the invention. Furthermore, by the method of the invention microorganisms stabilizing the functioning of the intestines may be introduced into a food product, the possibilities of functioning of said microorganisms being improved in accordance with the invention as the dietary fiber components protect them when they are passed in the digestive system.

State of the art

a) Dietary fiber

The significance of dietary fiber as a part of a healthy diet has been firmly substantiated by means of clinical and epidemiological studies in the course of the last few years. Particularly the health-promoting effects of oats have been discussed, but recently similar effects have been shown in other grain-derived and vegetable-derived fibers. Cereal bran - specifically oat bran - is rich in physiologically functional soluble fiber (such as beta-glucan) which has been shown to contribute to a decrease in the cholesterol level at least in individuals having a high serum cholesterol level (cf. Wood et al. 1989 and the references presented therein). The effect is considered to be based on the special ability of soluble fiber to bind bile acids through which the disadvantageous LDL cholesterol disappears from the blood. Food containing dietary fiber may also prevent cancer, such as colon cancer and breast cancer (National Cancer Institute 1986; Adlercreutz 1990). Dietary fiber in general improves the functioning of the digestive system in many ways.

Cereal bran is conventionally used for instance in bread, muesli and porridge and together with other foods, such as yoghurt or buttermilk. However, the problem lies in that despite the different ways of addition, dietary fiber, particularly soluble dietary fiber, is often obtained in amounts smaller than called for by the dietetic recommendations, and normally only a fraction of the quantity which has been shown to have for instance cholesterol-lowering effects. Thus it can be stated that the market still lacks grain products containing dietary fiber, such as oat products, which are significant in view of

nutritional targets.

b) Useful microbes

Many useful species of microbes having effects of reducing the growth of disadvantageous and pathogenic organisms live naturally in the gastrointestinal tract of man (and animals). The best known of these include lactobacillus organisms, such as Lactobacillus acidophilus which is industrially used in acidophilus sour milk products and in the preparation of pharmaceutical lyophilized products for elimination of disturbances in the microbial flora of the intestines subsequent to illnesses or for instance use of antibiotics (Kandler & Weiss 1986). In addition to certain Lactobacillus strains, also other lactic acid bacteria, such as streptococci and bifidobacteria and propionic acid bacteria, and certain other bacterial strains, are presumed to possess useful effects.

There are also indications of the fact that certain fermented products containing live lactic acid bacteria may have a beneficial effect on the serum cholesterol level and on the prevention of the genesis of colon cancer (Hepner et al. 1972, Goldin & Gorbach 1984).

It is typical of microbes useful for the digestive system that they can survive in the gastrointestinal tract and can check the other bacterial flora living in the intestines and the intestinal fermentation by means of their metabolic products.

It has now been found that some components of fermented food, such as dietary fiber remaining intact in the gastrointestinal tract, may protect microbes useful for the digestive system as they pass through the digestive tract. The ability of certain useful microbes to attach to surfaces is utilized

herein, as they pass through the digestive tract. The protecting effect of dietary fiber may also broaden the spectrum of organisms having useful effects.

c) Fermented grain products containing living microbes

Foods containing live lactic acid bacteria are known, whereof specifically sour milk products and vegetable products prepared by souring, such as sauerkraut, certain pickles and certain delicacy cucumbers, may be mentioned. On the other hand, the lactic acid bacteria used in the preparation of sour bread are destroyed when the bread is baked.

Grain products inoculated with certain organisms and containing said organisms as living microbes are not known to exist anywhere in the market, if home-brew or small beer containing lactobacilli as contaminants in addition to yeast is not taken into account. It is true that grain-based foods containing live lactobacilli are known in the food tradition and internationally. Among the traditional foods of Ladogan Karelia, for instance *kauramämmi* (fermented uncooked and unbaked oat pudding) soured with sourdough is mentioned (Lampinen 1970). With fermentation one aimed in particular at improving the taste.

The majority of the traditional soured cereal gruels were cooked after fermentation, and thus the possible useful sporogenous microbes were killed. This happened for instance in the preparation of *kiesu* flummery of Ladogan Karelia, in which sourdough was used as a starter (Talve 1961, Lampinen 1970). The same applies to the millet, corn, cassava, and other porridges and gruels which are still part of staple food in some other parts of the world, for instance Africa, and wherein no starter but spon-

taneous fermentation is used (for instance *ogi, koko, kenkey, uji*) (Odunfa 1985). However, a starter containing specific lactic acid bacteria is used in the modern preparation of the sour *mahewu* corn beverage powder favored by the Bantus of South Africa (Hesseltine 1979). Yet it is not known that one would have attempted to sour specifically cereal bran to improve its palatability and the hygienic properties of the product.

Evaluation of the prior art and its disadvantages

The present-day selection of food products lacks easy-to-use, tasty products containing dietary fiber. Ingestion of fiber products, such as oat bran, in a physiologically significant amount is often difficult and requires adding oat bran to other foods whereto it is not necessarily suited for its taste or other properties. Furthermore, also in that event the fiber has the beneficial effects of fiber only, since mere fiber does not have potential microorganisms useful for the digestive system.

Specific bacteria useful to digestion have long been commercially available in freeze-dried form. The problem with these products, however, is that obviously the majority of the bacteria are killed in the course of the commercial storage and distribution line, and at the latest in the stomach prior to the intestines. On the other hand, sour milk products containing fresh microorganisms useful for the digestive system are poorly or not at all suited to milk allergic persons or individuals suffering from lactose intolerance.

Characteristics of the invention

The method of the invention provides a possibility of preparing, even from plain cereal bran or

other fiber-containing material (and water), tasty products which are rich in (soluble) dietary fiber and which may have a very low energy value. The product may be prepared and seasoned into an easily ingestible yoghurt-type snackfood. No animal fat or milk solids are necessary in the preparation, wherefore the product is suitable to persons avoiding fat and milk products.

In addition to the fact that the cereal bran or other fiber-containing raw material has been brought into a tasty form in accordance with this invention, the fibrous material which is undecomposable in the digestive system serves as a protector and vehicle for the bacteria useful to health in the digestive tract, and hence improves the beneficial effect of these microbes on the digestive system.

Advantages of the invention over the prior art

The most important contribution of the invention is bringing the fibrous material into a tasty, easy-to-use form. Furthermore, the invention combines two health-promoting natural elements, fiber and useful microorganisms, in the same product so that new food products containing dietary fiber as wanted by nutrition experts are obtained.

Detailed description of the invention

Diagram 1 presents in a simplified way the steps of the preparation method in a case where the ingredient containing dietary fiber is oat bran. The ingredient containing dietary fiber and other polysaccharides is heated together with water and possible other materials so that (1) the starch is gelatinized and (2) those organisms in the ingredients which are contaminating or cause spoiling of foods are killed (pasteurizing/sterilizing effect). The heat treatment will gelatinize the starch and destroy

the microbes, 10^{4-5}/g, in the oat bran, yet not necessarily all heat-resistant bacterial spores. If necessary, the gruel may be sterilized for instance by UHT treatment. Pasteurization by cooking may, however, be a sufficient treatment, since the decrease in pH caused by the fermentation and the fermentation products check the growth of possible contaminating or health-hazardous sporogenous bacteria, such as Bacillus cereus. In connection with the heat treatment one may use added enzymes to modify the method or product. The gruel-like product cooled to a suitable temperature is inoculated with a useful microbe or a mixture of such, and the gruel is allowed to ferment under suitable conditions (generally 20 - 50°C) typically 3 h - 3 days depending on the starter organism. Particularly when bifidobacteria or propionic acid bacteria are used, the anaerobic technique may be employed. During the fermentation, the pH of the product will typically fall below the value pH 5, for instance to pH 4, which will protect the product from contamination and from the growth of microorganisms hazardous to health.

Subsequent to fermentation, the product is cooled to refrigerator temperature, possibly seasoned with berries, juices, sugar, salt or other seasonings, and packed. The product is ready to be ingested as such or together with milk, juice, jam, sugar or the like for instance at refrigerator temperature. The product will remain fit to eat in regard to texture and taste and microbiological quality several weeks stored in a refrigerator.

The recipe is for instance as follows: 1 part oat bran and 10 - 30 parts water. In special cases, the quantity of water may be lower, for instance 5 parts (1 part cereal bran). 20 minutes has been found

to be a sufficient heating time for the gruel at 100°C. In this time, the gelatinization can take place and the quantity of contaminating organisms fall very low or to zero. On account of the strong inoculum, for example 0.1 - 5% of a culture having a CFU content per g of more than 10^5, the pH starts rapidly decreasing, and the possible sporogenous bacteria and re-contaminants which have survived the heat treatment have no possibilities of growing. After the fermentation, the lactic acid content of the product (fresh weight) is characteristically 0.3 -1.0%. During cold storage, the lactic acid content increases. The product has a characteristic taste and odor of the organism/organisms used for the fermentation (for instance yoghurt-like taste and odor when yoghurt bacteria have been used as a starter). The energy value of the product is typically 50 - 150 kcal/100 g and the dietary fiber content 10 - 30 g/100 g (dry matter). The dry matter content of the product is 5 -15%. In special cases, the dry matter content of the product may be as high as 25%. The lactobacillus content of the product is 10^{5-8} CFU/g*, even as high as 10^{10} CFU/g. Table 1 sets forth a depiction of the typical properties of the product. Said values are based on generalizations made on the basis of results of tests carried out by scientific methods.

Table 1. Typical properties of product

Parameter	Value and unit
Dry matter content	5-15% (even as high as 25%)
pH	4-5 (even less than 4)
Lactic acid content	0.3-1.0% (fresh)
Energy value	50-150 kJ/100 g
Content of dietary fiber	10-30 g/100 g (dry matter)

Lactobacilli	10^{5-8} CFU/g* (even as high as 10^{10} CFU)
Yeasts/molds	0
Bacillus cereus	0
Hemolytic bacteria	0

* CFU = colony-forming unit

In the following examples, different modification alternatives of the preparation method and the resultant product have been described, under variation of the microorganisms used for fermentation, the process conditions, and ingredients. Diagram 1 presents in a simplified way the steps of the preparation method when oat bran is the ingredient containing dietary fiber, and the above-stated Table 1 describes the typical properties of the corresponding product. Certain variations have also been described in Table 2.

Example 1

One part oat bran and 20 parts water were thoroughly mixed. The mixture was heated to a temperature of 100°C under slow stirring for 20 minutes, whereby a pudding-like soft gruel was formed. The purpose of the heating was on the one hand to gelatinize the starch in the oat bran to attain an appropriate texture, and on the other hand to destroy contaminating microorganisms.

The gruel was cooled to a temperature of 37-45°C, whereby its viscosity increased. The gruel was inoculated with a starter containing Streptococcus thermophilus and Lactobacillus bulgaricus lactic acid bacteria and fermented within the said temperature range for more than 3 hours, whereby the pH fell below the value 4.5.

Depending on the quantity of the inoculum,

there were at least 10^{4-5}/g of lactic acid bacteria at the start of the fermentation and at least 10^{8-10}/g at the end of the fermentation. Subsequent to fermentation, the gruel was cooled to a temperature of about 6°C and packaged in amounts of 0.1 - 1 liters in plastic or glass containers. The packages were stored at refrigerator temperature (about +6°C).

Depending on the mixture ratios and mixing method, the prepared product had a consistency of the yoghurt, *viili* (clabbered milk), or jelly type and of a food product suitable for eating with a spoon or for drinking. The advantage of specifically oat bran in comparison with for instance oat flour was the pleasant texture which "snapped off" when spooned, which was due to the bran particles. The taste and odor were fresh and sour. A taste and odor resembling yoghurt could easily be detected. The color of the product was light, grayish, and depended on the properties of the oat bran used, such as the colour, starch, fiber, and hull content.

The pH of the product was 3.5-4.5, depending on the fermentation and storage method. The lactic acid content was for example about 0.4-0-5%, the dry matter content about 4-5 g/100 g and the dietary fiber content 0.6-1.0 g/100 g depending on the composition of the oat bran. The dietary fiber content per energy unit could be as high as 1.0-1.5 g/100 kJ.

In the microbiological sense and as evaluated in sensory tests, the product remained palatable several weeks at refrigerator temperature. The product characteristically contained at least 10^{5-8} CFU/g of live lactic acid bacteria. No wheying-off took place even in long-term storage when a suitable raw material and mixture ratio were used.

In vitro tests gave indication of the fact that

the probiotic lactobacilli adhere to the bran particles and that the bran particles may protect the adhesive lactic acid bacteria in the gastrointestinal tract.

Example 2

The procedure of Example 1 was followed, but using a Lactobacillus casei (Lactobacillus GG) lactic acid bacterium or a product containing it (Gefilus^{R}) as a starter; the fermentation temperature was 35°C. The quantity of live bacteria in the product was at least 10^{5-8} CFU/g depending on the storage time and temperature. The pH of the product was 3.5-4.5 and the taste was fresh and sour. The shelf life in a refrigerator was at least 2 weeks.

The in vitro tests indicated that said lactobacillus adheres to the bran particles and that the bran particles can be presumed to improve the therapeutic properties of this lactobacillus in the intestines.

Example 3

Liquid fluid, jelly-like, or porridge-like half-solid products were prepared of oat bran using the microorganisms listed in Table 2 for the fermentation and following the methods disclosed in Examples 1 and 2. Fermentation times and temperatures optimal to each starter were applied in the fermentation. The pH of the product was typically 3.5-4.5 and the taste was sour.

Example 4

Fermentation was carried out on an uncooked mixture containing oat bran, otherwise implementing Examples 1-3. Even though the oat bran may be heat treated when dry in advance and its microbial content thereby lowered, in this alternative method special attention has to be paid to the microbiological

impeccability of the raw material used and the rapid decrease of the pH to prevent the growth of contaminating microbes. The consistency and other properties of the product may be adjusted by means of the ingredients and their ratios and with possible enzymatic treatments. The pH of the test products prepared was 4.0-4.5 and their taste was sour.

Example 5

The starting material is another fraction derived from grain, vegetables or fruit and containing dietary fiber. The preparation takes place applying the principles set forth in Examples 1-4. The properties of the products vary in accordance with the properties of the ingredients and additives and of the starter used.

Example 6

Bifidobacteria or propionic acid bacteria are used for the fermentation, possibly in combination with the use of lactic acid bacteria. The fermentation of the different bacterial species may be carried out separately before the combination of the ingredients.

Example 7

Regardless of the alternatives of the preparation method (Examples 1-6), one uses instead of oat bran or in combination therewith other ingredients containing dietary fiber or mixtures of such, possibly in combination with other food ingredients and additives. Ingredients containing dietary fiber may be for instance oat, wheat, or barley flour, rolled oats, oat fiber product, barley fiber product, other cereal bran fraction, *talkkunajauho* (cooked, dried oatmeal powder), or other material containing vegetable fiber.

The taste, odor, color, texture and other sen-

sory qualities and the nutritive value of the product may be greatly modified and improved by using as ingredients, besides the bran-containing raw material, milk, milk powder or other milk-derived product, soya flour, a protein product, starch, sugar, honey, berries, fruit, vegetables, or jams, juices, or concentrates made of these, coffee, cocoa, etc., or food additives (salt, aromatic and coloring substances, stabilizing and thickening agents, etc.).

The nutritional value of the product may further be modified by using as ingredients leguminous plants or animal-derived products, or food ingredients produced of these.

The ingredients modifying the taste, nutritional value, and other properties may be added either prior to cooking, prior to fermentation, in connection with packaging into portions, or as late as on the serving occasion, for instance depending on whether industrial or catering-type production of ready-made food products is concerned.

Example 8

A product prepared following the principles of Examples 1 - 7 may be used as an ingredient of other foods, such as milk, meat, vegetable, and cereal products, in which case the fermented fiber-containing product has an effect on the taste and nutritional value or other properties or also on the therapeutic properties of the product, depending on the application and the product.

Example 9

The product may be prepared in accordance with the examples disclosed above, freeze-dried, and used as mixed in water, milk, juice, etc.

Alternative modifications of the invention

It is particularly to be noted that the method

of the invention may also be applied to the fermentation of other material containing dietary fiber or to the fermentation of another product containing dietary fiber, such as a fraction prepared of apple, sugarbeet, etc. containing dietary fiber.

Furthermore, it is to be noted that the invention has been explained in the foregoing chiefly with reference to a few preferred embodiment examples. Yet hereby it not wished to restrict the invention to relate to these examples by any means, but many modifications are possible within the scope of the inventive idea defined in the ensuing claims.

Diagram 1. Flow chart of the different steps of the preparation method

Oats

Milling (dry or wet grinding)

Oat bran

Mixing with water

Heat treatment
(gelatinization of starch &
pasteurization/sterilization)

Cooling to fermentation temperature

Inoculation with microbial starter

Fermentation

Possible seasoning with fruit,
berries and/or sugar

Cooling
to refrigerator temperature

Packaging/storage/delivery in cold line

Cold-eaten product
(easy-to-use snack or dessert, or may be
used for the preparation of other food products)

Table 2.
Examples of starters suitable for the fermentation of gruel cooked from cereal bran, of the fermentation conditions, and products

Starter organism	Ferment. temp.	Ferment. time	Final pH	Shelf life at +5 C	Typical taste
L. bulgaricus/ S. thermophilus (yoghurt)	35-45 C	3-5h	c. 4.3	> 2 weeks	yoghurt like
Lactobacillus casei (GG)	37-42 C	12-24 h	c. 4.3	> 2 weeks	sour
L. acidophilus/ L. bulgaricus/ S. thermophilus (Acidophilus yoghurt)	35-45 C	3-5 h	c. 4.3	> 2 weeks	sour
Lactobacillus sp. (collected strains)	35-40 C	12 h	c. 4.3	> 2 weeks	sour
S. lactis/ S. cremoris/ S. diacetylactis/ Leucon. cremoris (buttermilk)	20-35 C	12-24 h	c. 4.3	> 2 weeks	sour
L. kefir/ S. lactis/ S. cremoris/ L. brevis/ Leuconostoc sp./ Torulopsis sp. (kefir)	20-35 C	12-24 h	c. 4.3	> 2 weeks	sour
S. lactis/ S. cremoris/ S. diacetylactis/ L. cremoris/ P. acidilactici (clabbered milk)	20 C	12-24 h	c. 4.3	> 2 weeks	sour
Sourdough starter (lactobac. & yeast)	25-30 C	12-24 h	c. 4.3	> 1 week	sour

* at the end of fermentation

Claims:

1. A food product prepared by fermentation, based substantially on cereal bran, containing living microorganisms, and being nutritionally beneficial, beneficial to health, and tasty.

2. A food product as claimed in claim 1, characterized in that its principal composition is as follows:

Dry matter content	5-25%
Lactic acid content	0.3-1.0% (fresh)
Energy value	50-150 kJ/100 g
Dietary fiber content	10-30 g/100 g (d.m.)
Lactobacilli	10^{5-10} CFU/g

and that it has a pH of 3.5-5, and it does not contain harmful microorganisms.

3. A food product as claimed in claim 2, characterized in that its principal composition is as follows:

Dry matter content	5-15%
Lactic acid content	0.3-1.0% (fresh)
Energy value	50-150 kJ/100 g
Dietary fiber content	10-30 g/100 g (d.m.)
Lactobacilli	10^{5-8} CFU/g

and that it has a pH of 3.5-5, and it does not contain harmful microorganisms.

4. A food product as claimed in claim 1 to 3, characterized in that the dietary fiber is mainly derived from oat bran.

5. A food product as claimed in claim 1 to 3, characterized in that the dietary fiber is mainly derived from barley, wheat, rice, millet, or corn bran.

6. A method of preparing a fermented food product based substantially on cereal bran, containing living bacteria, by which method nutritionally

beneficial, wholesome, and tasty food products can be produced, characterized in that a raw material comprising cereal bran or substantially cereal bran is fermented as an aqueous mixture by means of microorganisms which are known per se and which are advantageous in view of the technology, health, or the quality of the product.

7. A method as claimed in claim 6, characterized in that oat bran is used as the starting material.

8. A method as claimed in claim 6, characterized in that the dietary fiber is derived from barley, wheat, rice, millet, or corn bran.

9. A method as claimed in claims 6 to 8, characterized in that a mixture of oat, barley, wheat, rice, millet, or corn bran and a cereal, vegetable, fruit, or berry is used as the starting material.

10. A method as claimed in claims 1 to 9, characterized in that the microorganism beneficial to health which is used for the fermentation is Lactobacillus or some other lactic acid bacterium, bifidobacterium, propionic acid bacterium or another beneficial bacterium, or a mixture of such bacteria or other like bacteria.

11. A method as claimed in claims 1 to 10, characterized in that the microorganism is Lactobacillus casei (Lactobacillus GG).

12. A method as claimed in claims 1 to 10, characterized in that the microorganism is Lactobacillus acidophilus.

13. A method as claimed in claims 1 to 10, characterized in that the microorganism is Lactobacillus bulgaricus.

14. A method as claimed in claims 1 to 10,

characterized in that the microorganism is Lactobacillus sp. (some other species of the genus Lactobacillus).

15. A method as claimed in claims 1 to 10, characterized in that the microorganism is Streptococcus sp. (species of the genus Streptococcus).

16. A method as claimed in claims 1 to 10, characterized in that a mixture of microorganisms having two or more of the following microorganisms is used for the fermentation: Lactobacillus acidophilus, Lactobacillus bulgaricus, Lactobacillus thermophilus and Lactobacillus casei.

AMENDED CLAIMS

[received by the International Bureau on 15 October 1991 (15.10.91); original claims 1-6 and 8 amended; remaining claims unchanged (3 pages)]

1. A food product prepared by fermentation, based substantially on a fraction of cereal grain high in dietary fibre, and containing living microorganisms, and being nutritionally beneficial, beneficial to health, and tasty.

2. A food product as claimed in claim 1, c h a r a c t e r i z e d in that its principal composition is as follows:

Dry matter content	5-25%
Lactic acid content	0.3-1.0% (fresh)
Energy value	50-150 kJ/100 g
Dietary fibre content	10-30 g/100 g (d.m.)
Lactobacilli	10^{5-10} CFU/g

and that it has a pH of 3.5-5, and it does not contain harmful microorganisms.

3. A food product as claimed in claim 2, c h a r a c t e r i z e d in that its principal composition is as follows:

Dry matter content	5-15%
Lactic acid content	0.3-1.0% (fresh)
Energy value	50-150 kJ/100 g
Dietary fibre content	10-30 g/100 g (d.m.)
Lactobacilli	10^{5-8} CFU/g

and that it has a pH of 3.5-5, and it does not contain harmful microorganisms.

4. A food product as claimed in claim 1 to 3, c h a r a c t e r i z e d in that the dietary fibre is mainly derived from oat bran.

5. A food product as claimed in claim 1 to 3, c h a r a c t e r i z e d in that the dietary fibre is mainly derived from barley, wheat, rice, millet, or corn bran.

6. A method of preparing a fermented food product based substantially on a fraction of cereal

grain high in dietary fibre, and containing living bacteria, by which method nutritionally beneficial, wholesome, and tasty food products can be produced, characterized in that a raw material comprising a fraction of cereal grain high in dietary fibre is fermented as an aqueous mixture by means of microorganisms which are known per se and which are advantageous in view of the technology, health, or the quality of the product.

7. A method as claimed in claim 6, characterized in that oat bran is used as the starting material.

8. A method as claimed in claim 6, characterized in that the dietary fibre is derived from barley, wheat, rice, millet, or corn bran.

9. A method as claimed in claims 6 to 8, characterized in that a mixture of oat, barley, wheat, rice, millet, or corn bran and a cereal, vegetable, fruit, or berry is used as the starting material.

10. A method as claimed in claims 1 to 9, characterized in that the microorganism beneficial to health which is used for the fermentation is Lactobacillus or some other lactic acid bacterium, bifidobacterium, propionic acid bacterium or another beneficial bacterium, or a mixture of such bacteria or other like bacteria.

11. A method as claimed in claims 1 to 10, characterized in that the microorganism is Lactobacillus casei (Lactobacillus GG).

12. A method as claimed in claims 1 to 10, characterized in that the microorganism is Lactobacillus acidophilus.

13. A method as claimed in claims 1 to 10, characterized in that the microorganism

is Lactobacillus bulgaricus.

14. A method as claimed in claims 1 to 10, c h a r a c t e r i z e d in that the microorganism is Lactobacillus sp. (some other species of the genus Lactobacillus).

15. A method as claimed in claims 1 to 10, c h a r a c t e r i z e d in that the microorganism is Streptococcus sp. (species of the genus Streptococcus).

16. A method as claimed in claims 1 to 10, c h a r a c t e r i z e d in that a mixture of microorganisms having two or more of the following microorganisms is used for the fermentation: Lactobacillus acidophilus, Lactobacillus bulgaricus, Lactobacillus thermophilus and Lactobacillus casei.

INTERNATIONAL SEARCH REPORT

International Application No PCT/FI 91/00157

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all)[6]

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC5: A 23 L 1/105, 1/308

II. FIELDS SEARCHED

Minimum Documentation Searched[7]

Classification System	Classification Symbols
IPC5	A 23 L

Documentation Searched other than Minimum Documentation to the Extent that such Documents are Included in Fields Searched[8]

SE,DK,FI,NO classes as above

III. DOCUMENTS CONSIDERED TO BE RELEVANT[9]

Category *	Citation of Document,[11] with indication, where appropriate, of the relevant passages[12]	Relevant to Claim No.[13]
X	DE, C2, 3706303 (DÜLSEN NATURPRODUKTE GMBH) 17 November 1988, see claims 1,2 --	1,4-12, 16
X	EP, A2, 0228074 (ISOTEC CO., LTD.) 8 July 1987, see page 2, line 19 - line 54 --	1,5,6,8, 10
X	WO, A1, 8908405 (MOLIN, NILS ET AL.) 21 September 1989, see page 4, line 18 - line 20; page 4, line 30; claims 1-3,11 --	1,4-10, 12,14
X	DE, B2, 2004406 (KEIMDIÄT) 30 September 1971, see claim 1 --	1,6, 10

* Special categories of cited documents: [10]

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

"L" document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)

"O" document referring to an oral disclosure, use, exhibition or other means

"P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step

"Y" document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

IV. CERTIFICATION

Date of the Actual Completion of the International Search	Date of Mailing of this International Search Report
6th August 1991	1991 -08- 15
International Searching Authority	**Signature of Authorized Officer**
SWEDISH PATENT OFFICE	Inga-Karin Petersson

Form PCT/ISA/210 (second sheet) (January 1985)

III. DOCUMENTS CONSIDERED TO BE RELEVANT (CONTINUED FROM THE SECOND SHEET)

Category *	Citation of Document, with indication, where appropriate, of the relevant passages	Relevant to Claim No
A	EP, A1, 0258486 (SOCIETE DES PRODUITS NESTLE S.A.) 9 March 1988, see page 3, line 3 - line 6; claims 1-5 --	1,4,6,7
P,X	DE, A1, 3905055 (PETER ECKES KG MBH) 23 August 1990, see claim 1 --	1,4-10
P,X	GB, A, 2225922 (SAMUEL KURIA MBUGUA) 20 June 1990, see claim 1 --	1,6,10, 14

ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO.PCT/FI 91/00157

This annex lists the patent family members relating to the patent documents cited in the above-mentioned international search report.
The members are as contained in the Swedish Patent Office EDP file on 91-06-27
The Swedish Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

Patent document cited in search report	Publication date	Patent family member(s)		Publication date
DE-C2- 3706303	88-11-17	NONE		
EP-A2- 0228074	87-07-08	JP-C-	1467463	88-11-30
		JP-A-	61171680	86-08-02
		JP-B-	63011198	88-03-11
		JP-A-	62158449	87-07-14
WO-A1- 8908405	89-09-21	AU-D-	3298089	89-10-05
		EP-A-	0415941	91-03-13
		SE-B-	463796	91-01-28
		SE-A-	8800822	89-09-10
DE-B2- 2004406	71-09-30	NONE		
EP-A1- 0258486	88-03-09	US-A-	4857356	89-08-15
		ZA-A-	8706231	88-03-01
DE-A1- 3905055	90-08-23	NONE		
GB-A- 2225922	90-06-20	NONE		